

A Reliable, Efficient Cryogenic Propellant Mixing Pump with No Moving Parts, Phase I

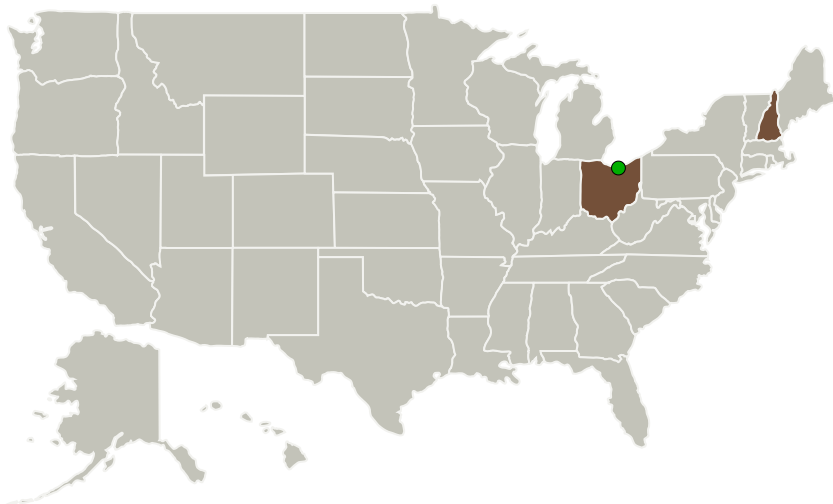
Completed Technology Project (2013 - 2013)



Project Introduction

Refueling spacecraft in space offers tremendous benefits for increased spacecraft payload capacity and reduced launch cost. A key technology challenge for space refueling is the storage of liquid cryogenic fuel in space. To meet this need, we propose to develop a reliable, compact, efficient cryogenic mixing pump with no moving parts. The mixing pump will prevent thermal stratification of the cryogen and simplify pressure control for storage tanks. The mixing pump uses an innovative thermodynamic process to generate fluid jets to promote fluid mixing, eliminating the need for mechanical pumps. Our innovative mechanism will be able to self-prime and generate a high-pressure rise. The device will significantly enhance the reliability of pressure control systems for storage tanks. In Phase I, we will prove the feasibility of our approach through building and testing a proof-of-concept mixing pump and developing an analytical model to optimize the mixing pump design. In Phase II, we will build and test a laboratory-scale cryogenic mixing pump and demonstrate its performance in a representative cryogenic environment.

Primary U.S. Work Locations and Key Partners



Operating T: 20 K
 ΔP : 100 mbar
Flow rate: 100 L/min
Power input: 25 W
Overall size: ~2 L
Highly scalable
No piston or impeller

Discharged Cryogen

Superconducting magnet

Pumping Chamber

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Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

New Hampshire	Ohio
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Project Transitions

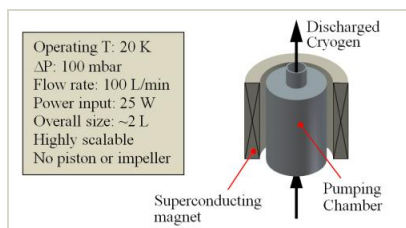
▶ **May 2013:** Project Start

✓ **November 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140390>)

Images



Project Image

A Reliable, Efficient Cryogenic Propellant Mixing Pump With No Moving Parts

(<https://techport.nasa.gov/image/136989>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Creare LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Weibo Chen

Co-Investigator:

Weibo Chen

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Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.1 In-space Propellant Storage & Utilization

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System